A STUDY ON EFFECT OF LUMBO-PELVIC STABILITY EXERCISES ON MOTOR FITNESS VARIABLES AMONG TRIPLE JUMPERS

Dissertation

Submitted to

The Tamilnadu Dr.MGR Medical University

In partial fulfillment for the degree of

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(SPORTS PHYSIOTHERAPY)

271450121

CHERRAAN'S COLLEGE OF PHYSIOTHERAPY

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Coimbatore, Tamilnadu, India.

MAY 2018

CERTIFICATE

The work embodied in the thesis entitled **"A STUDY ON EFFECT OF LUMBO-PELVIC STABILITY EXERCISES ON MOTOR FITNESS VARIABLES AMONG TRIPLE JUMPERS"** 'submitted to the **Tamilnadu Dr. MGRMedical University, Chennai** in the partial fulfillment for the degree **of Master of physiotherapy (sports physiotherapy)**, was carried out by candidate bearing register number of **271450121** at Cherraan's college of physiotherapy, Coimbatore under my supervision. This is an original work done by her and has not been submitted in part or full for any other degree/diploma at this or any other university/institution. The thesis is fit to be considered for evaluation for award of the degree of Master of Physiotherapy.

……..... .....

Signature of Supervisor
Mr.A.CHINNACHAMY MPT (Sports)

Signature of principal
Mrs.E.SELVARANI, MPT (Neuro)

Date:…… **Date:**……

…… ……..

Internal Examiner **External Examiner**

Project work evaluated on…….

DECLARATION

I hereby declare and present my project work entitled "**A STUDY ON EFFECT OF LUMBO-PELVIC STABILITY EXERCISES ON MOTOR FITNESS VARIABLES AMONG TRIPLE JUMPERS**''The outcome of the original research work undertaken and carried out by me, under the guidance of Professor. **Mr.Chinnachamy, MPT (Sports),** Cherraan's college of physiotherapy,Coimbatore. I also declare that the material of this project work has not formed in anyway the basis for the award of any other degree previously from the Tamilnadu Dr. MGR Medical University.

…….. ……

Signature of Supervisor **Signature of Student**

Mr.A.Chinnachamy MPT (Sports) **R.Karthikeyan**

Date:

Place:

ACKNOWLEDGEMENT

I would like to thank all the people who contributed in some way to work described in this thesis. First and foremost, I thank my principal **Mrs E.SELVARANI MPT (Neuro)** for helping, supporting and encouraging me in all my way to complete my thesis.

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I am gratefull to thank to the patients who co-operated and followed according to my advice throughout the seasons.

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ABSTRACT

A STUDY ON EFFECT OF LUMBO-PELVIC STABILITY EXERCISES ON MOTOR FITNESS VARIABLES AMONG TRIPLE JUMPERS

OBJECTIVES :

To determine the effect of core muscle strengthening on power ,speed and agility of collegiate triple jumpers.

DESIGN :

Pre-test Post-test Experimental Design

PARTICIPATION :

15 subjects aged between 18 to 22 years who fulfilled inclusion and exclusion criteria were selected by purposive sampling methods and randomly assigned.

RESULTS :

The calculated paired 't'value for power is (23.09),speed 't'value (32.17) and agility 't'value (44.08).Table 't' value is 2.97 at 0.005 level of significance. Hence the calculated't' value is greater than the Table 't' value there is significant difference in power ,speed agility following the core strengthening exercise in collegiate triple jumpers**.**Since we accept alternative hypothesis and reject null hypothesis**.**

CONCLUSION:

It is concluded that there is improvement of core muscle strength in the athletics.

It is concluded that there is improvement in speed,agility and power treated with core muscle strength.

KEY WORDS :

Triple jumpers,Motor fitness,core stability exercise,Treatment outcome.

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I. INTRODUCTION

The deep muscles of the stomach and low back are the core muscles of your body. They support and protect the low back and also help the leg and arm muscles work well.

The core muscles are the superficial and the deep spinal extensors muscles, abdominal muscles, pelvic floor muscles and shoulder girdle and hip girdle muscles.

Core muscle strength is usually operationally defined by a measurement of the strength of core muscles, either in terms of how much weight/ resistance a muscle can lift how many repetitions a muscle can perform, or how long a muscle can hold a neutral stable position.

Core strength should be distinguished from core stability. In the Physical Therapy literatures the historically older term is "core stability". In the latter part of 1980's a concept of neutral spine developed among physical therapists and physicians who were treating individuals with back pain.

Spinal stability as consisting of three subsystems,passive components of spinal column, active control by spinal muscles and nuero muscular control or coordination. When the muscles in the hip, shoulder girdle and trunk work together they form a functional segment called the core. (Dr.Panjabi(1992)

Some experts argue that to measure core muscle strength when the spine is moving is not an appropriate measure of core muscle strength; because the more important measure is how well the core muscles can hold the spine trunk still and relatively stable while the extremities are moving. One measure of core muscle strength is how long an individual can hold a prone or side plank position. Others have measured the amount of force a hip muscle can hold an isometric muscle contraction. Others use a sequence of lying leg lifting while maintaining the spine in a neutral alignment. (Damien Howell MS, PT,OCS)

The research in trunk control has been an important contribution to the understanding of neuro muscular reorganisation in back pain and injury. As long as four decades ago it was shown that motor strategies changes in injury and pain. (Freeman Etal, 1965).

The core stability studies confirmed that such changes take place in motor control of the trunk muscles of patients who suffer from back injury or pain.

Several assumptions prevalent in core stability training ;

- Certain muscles are more important for stabilisation of the spine than other muscles, in particular transverses abdominals.
- Weak abdominal muscles lead to back pain.
- Strengthening abdominal or trunk muscle can reduce back pain.
- There is a unique group of core muscle working independently of other trunk muscles.
- Back pain can be improved by normalising the timing of core muscles.
- There is a relationship between stability and back pain.

  (Journal of Body Work and Movement Therapy (2010) 14, 84-98)

The problem with the concept of training specifically for "core" stabilisation is that it doesn't make any sense. Leaving aside the arguments for using it to prevent back pain in sedentary populations, it proceeds from several ridiculous assumptions, and it is completely implacable to an athletic who is training properly on a basic barbell program. While it is absolutely true that all movements in sports that involve a ground reaction – a movement involving the feet generating power against the ground while the body, usually through the hands, applies it to a resistance – utilise the pelvic and trunk musculature to stabilise the spine during the movement.

For triple jumpers whose events involve balanced and powerful movements of the body propelling itself forward and catching itself in complex motor patterns a strong foundation of muscular balance is essential. In many runners, however, even those at an Olympic level, the core musculature is not fully developed.

ANATOMY OF CORE MUSCLE

The core acts through the thoraco lumbar fascia "nature's belt". The transverse abdominis has large attachment to the middle and posterior layers of thoraco lumbar fascia. The deep lamina of the posterior layer attaches to the lumbar spinous process. The thoraco lumbar fascia serves as part of a "hoop" around athe trunk that provide a connection between the lower limb and upper limb. Two types of muscle fibres comprise the core muscle: slow twitch and fast twitch.

Slow twitch fibres makes up the deep muscle layer. They are short in length and are suited for controlling inter segmental motion and responding to change in postures and extrinsic loads. Slow twitch muscles are Transverse abdominus, Multifidus, Internal oblique, Deep transversospinalis and Pelvic floor muscles

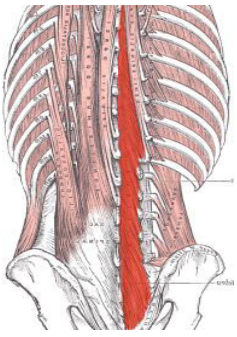
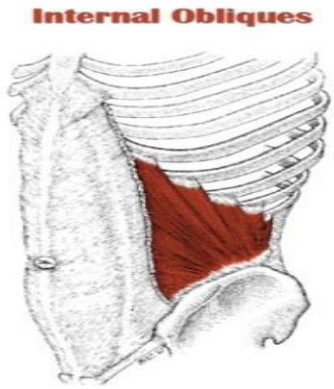
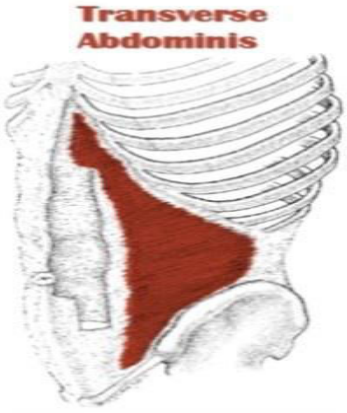


fig 1-Multifidus - located under the erector spine along the vertebral column, these muscles extend and rotate the spine

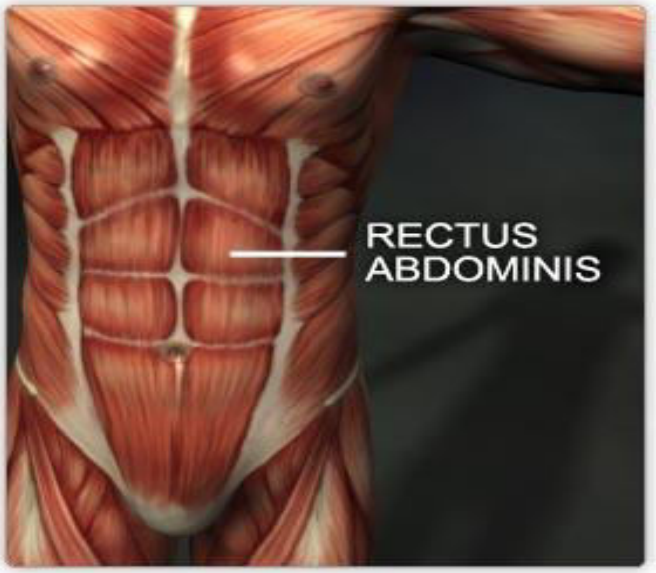


- **fig 2** - Internal Obliques - located under the external obliques, running in the opposite direction.

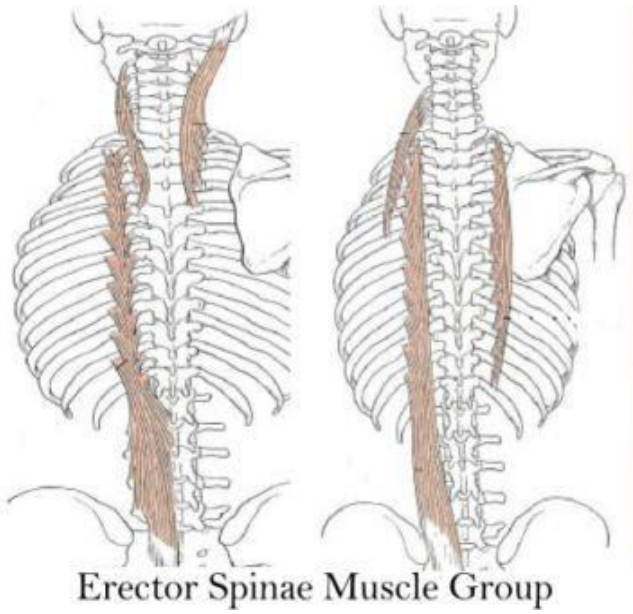


- **fig 3-** Transverse Abdominis (TVA) - located under the obliques, it is the deepest of the abdominal muscles (muscles of your waist) and wraps around your spine for protection and stability.

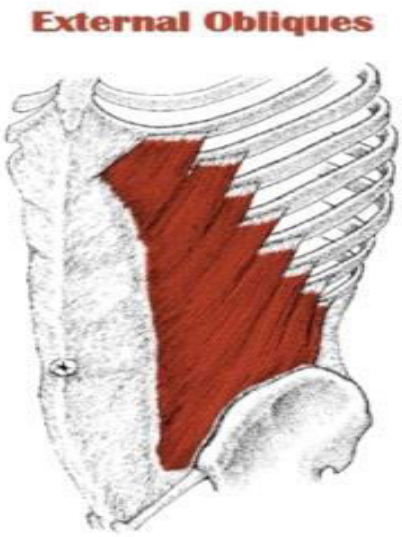
Fast twitch fibres comprises the global muscle system. These muscles are long and possess large lever arms, allowing them to produce large amount of torque and gross movement. Fast twitch muscles are Errectorspinae, External oblique, Rectus abdominis muscle and Quadratuslumborum.



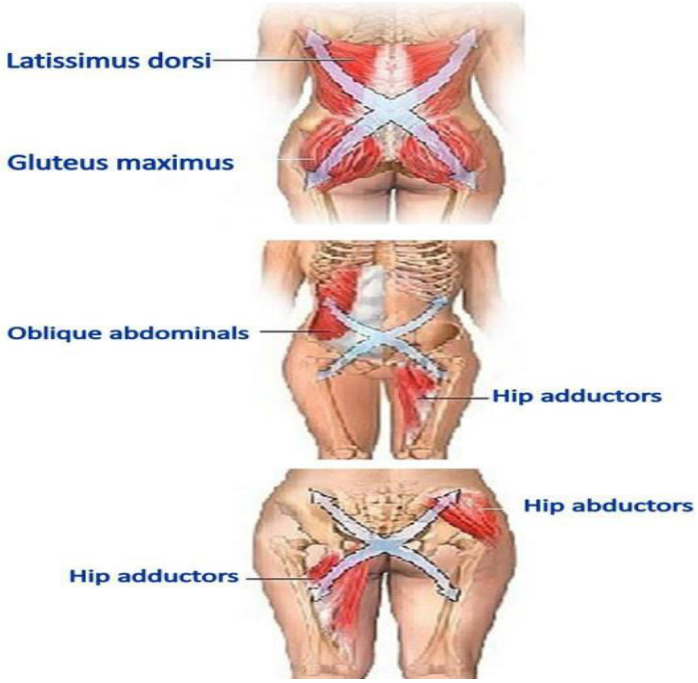
- **fig 4**- Rectus Abdominis – located along the front of the abdomen, this is the most well-known abdominal muscle and is often referred to as the "six-pack" due to its appearance in fit and thin individuals.



- **fig 5**- Erector Spinae- This group of three muscles runs along your neck to your lower back.



- **fig 6-**External Obliques - located on the side and front of the abdomen.



- **fig 7**- Hip Flexors - located in front of the pelvis and upper thigh. The muscles that make up the hip flexors include: psoas major, illiacus, rectus femoris, pectineus, sartorius
- Gluteus medius and minimus - located at the side of the hip
- Gluteus maximus, hamstring group, piriformis - located in the back of the hip and upper thigh leg.
- Hip adductors - located at medial thigh.

STABILIZERS	**PRIMARY STABILIZERS :** □ Deep, close to joint □ Slow twitch □ Usually monoarticular (1joint) □ No significant torque □ Short fibers **SECONDARY STABILIZERS :** Intermediate depth □ Slow twitch □ Usually monoarticular□ Primary source of torque □ Attachments are multipennate	Build tension slowly, more fatigue resistant □ Better activated at low levels of resistance □ More effective in closed chain movement □ In muscle imbalance, tend to weaken and lenghten
MOBILIZERS	□ Fast twitch □ Often biarticular (2 joints) □ Secondary source of torque	□ Build tension rapidly, fatigue quickly □ Better activated at high levels of resistance □ More effective in open chain movements □ In muscle imbalance, tend to tighten and shorten

Table 1; fast twitch and slow twitch core muscles

Stabilizers		Mobilizers
Primary ➢ Multifidus ➢ Transverse abdominis ➢ Internal oblique ➢ Gluteus medius ➢ Vastusmedialis ➢ Serratus anterior ➢ Lower trapezius ➢ Deep neck flexors	Secondary ➢ Gluteus maximus ➢ Quadriceps ➢ Iliopsoas * ➢ Subscapularis ➢ Infraspinatus ➢ Upper trapezius ➢ Quadratuslumborum *	➢ Iliopsoas * Rectus femoris ➢ Hamstrings ➢ Tensor fasciae lata ➢ Hip adductors ➢ Rectus abdominis External oblique Quadratuslumborum ➢ Erector spinae ➢ Upper trapezius

Table 2; mobilizers and stabilizers of core muscles.

Benefits of Core Stability Training

Quite simply, good core stability can help maximise running performance and prevent injury. Power is derived from the trunk region of the body and a properly conditioned core helps to control that power, allowing for smoother, more efficient and better coordinated movements in the limbs. Moreover, well conditioned core muscles help to reduce the risk of injury resulting from bad posture. The ability to maintain good posture while running helps to protect the spine and skeletal structure from extreme ranges of movement and from the excessive or abnormal forces acting on the body.

Core Stability Exercises

- Crunches
- Oblique crunches
- The Plank
- Oblique Plank
- Static leg and back
- Dynamic leg and back
- Hamstring Raises
- Superman
- Held straight legs
- Controlled lowering and raising of legs
- Hundreds

MOTOR FITNESS

Motor fitness refers to the capability of an athlete to perform effectively at their particular sport. The components of motor fitness are; Agility, Balance, Co-ordination, Power which entails speed and strength and finally Reaction time. Improving motor fitness involves a training regimen in all six. Improving this form of fitness is an indirect result of training in any of these attributes. All six components of motor fitness are essential for competing at high levels, which is why the concept is seen as an essential part of any athlete's training regime.

There are many different manifestations of fitness. Some examples include strength, stamina, speed and flexibility. Certain types of fitness, such as an athlete's cardiac fitness level are more important than others. An athlete needs to be aware of the various types of fitness to develop an effective training programme that focuses on weak or important areas.

COMPONENTS OF MOTOR FITNESS

AGILITY

Agility refers to the body's ability to perform quick movements in different directions. It is sometimes described as how fast an athlete is able to change direction while competing on the field or on the court. Improving agility often involves sprinting between cones that are placed at a variety of angles. It is the ability to minimise transition time from one movement pattern to another. It requires a combination of co-ordination, balance, speed, reflexes and strength. It is an integral component of most athletic activities, especially those involving a timely response to an opposing player. Agility exercises are not cardiovascular but designed to enhance the speed and power.

CO-ORDINATION

Co-ordination is the more difficult to describe than agility because it cannot be observed directly. An athlete with a high level of co-ordination is able to combine all forms of fitness- not just those are part of motor fitness- in an effective and controlled way. The more co-ordinated an athlete is, the more efficient he or she will be during competitive activities. Motor co-ordination is the co-ordinated functioning of muscles or groups of muscles in the execution of a complex task. It is a global system made up of several synergistic elements and not necessarily a singularly defined ability. Co-ordination is in essence, the ability to integrate all the components of fitness so that effective movements are achieved. Rhythm, spatial orientation and ability to react to both auditory and visual stimulus have also been identified as elements of co-ordination.

Motor co-ordination can be broken into two component; Gross motor co-ordination and

fine motor co- ordination. Gross motor co-ordination refers to gross motor skills, such as walking, running, climbing, jumping etc. Fine motor co-ordination refers to fine motor skills such as drawing, writing, typing etc.

POWER

Power refers to the athlete's ability to contract his or her muscles forcefully in an explosive movement. Most people have an intuitive sense of what power is, and why it is important for sports. Powerful athletes are not merely strong; they are able to use that strength quickly and efficiently. The ability to exert maximum muscular contraction instantly in an explosive burst of movement.ie; the ability of a muscular unit, or combination of muscular units to apply maximum force in minimum time. The two components of power are strength and speed. It is a vital component of motor fitness and is applicable especially to a myriad of athletic activities.

BALANCE

Balance is stability produced by distribution of weight. Balance being the ability to control the body's position and movement, is a key component to nearly every athletic activity. Balance is one of the important components of motor fitness and should be integrated into every general conditioning programme.

SPEED

Speed is the rate of motion, or equivalently the rate of change in position, often expressed as distance travelled per unit of time. A sub category of speed is quickness, which is the ability of the central nervous system to contract, relax or control muscle function without involvement of any preliminary stretch. Speed is the ability to move body swiftly and to perform a movement in very short period of time. Speed is defined as the state of moving swiftly. It is possible to improve on speed with one exercise. Sprinting is a good example. Starting with stimulus, such as stop watch or alarm, run forward a designated length. Time the sprint and work on improving speed.

REACTION TIME

Reaction time is how quickly the athlete can respond to a changing situation. It is the interval between the presentation of a stimulus and the muscular response to that stimulus. A primary factor affecting a response is the number of possible stimuli, each requiring their own response, that are presented. Tests show that reaction time speeds up naturally with increased heat rate and the release of adrenaline.

Improving all these components of motor fitness is important for any athlete who wants to achieve his or her best.

FINDING CORE

Deep Abdominals Lie on the floor on the back, knees bent, hands open by the side and with the spine in a small arch in the lower back. Practise breathing in and out slowly. Focus on the rise and fall of the rib cage whilebreathing. Now try to connect to pulling in your lower abdomen as you breathe out, aiming to keep your spine in exactly the same position as you breathe.

Deep Back and Shoulder Repeat the deep abdominals techniques but now, as you breathe out also think about drawing your shoulder blades back and down, flattening them into the back of your rib cage. You can try walking your fingers towards you feet to help with this.

Pelvic Floor Repeat the above but now, as you breathe out also think about pulling up muscles from underneath and inside, as if you were trying to stop yourself from going to the toilet.

By becoming more conscious of all of the above you can help to make your spine, pelvis and upper back far more stable. The stronger your core, the more stable these areas will be when you run.

1.1 NEED OF THE STUDY

Core stability is the ability of the lumbopelvic hip complex . The reason of the study is to find the change in motor fitness variables due to the increase of core muscle strength in triple jumpers

1.2 OBJECTIVES OF THE STUDY.

- To determine the efficacy of core muscle strengthening in power of triple jumpers.
- To determine the efficacy of core muscle strengthening in speed of triple jumpers.
- To determine the efficacy of core muscle strengthening in agility of triple jumpers.

1.3 STATEMENT OF THE PROBLEM

"The study on the efficacy of the lumbo-pelvic stability and its influence on motor fitness variables among triple jumpers"

1.4 HYPOTHESIS

Null hypothesis

There is no significant different in motor fitness variables following lumbo-pelvic stability exercises among in triple jumpers.

Alternative hypothesis

There is significant different in motor fitness variables following lumbo-pelvic stability exercises among in triple jumpers.

1.5 OPERATIONAL DEFINITION.

Lumbopelvic stability

Pelvic Stability refers to the ability of the trunk and pelvic muscle to keep the spine and pelvis in its optimal position during sporting activity. If these structures are kept in an optimal alignmentthen the muscles and joints of the lower limbs are able to function efficiently. If these structures are not kept in optimal alignment, then the resultant poor joint and muscle function can lead to injury and pain in the spine and lower limbs.

Triple jump.

The triple jump, sometimes referred to as the hop, step and jump or the hop, skip and jump, is a track and field sport, similar to the long jump, but involving a "hop, bound and jump": the competitor runs down the track and performs a hop, a bound and then a jump into the sand pit.

Motor fitness variables.

Motor fitness refers to the capability of an athlete to perform effectively at their particular sport. The components of motor fitness are; Agility, Balance, Co-ordination, Power which entails speed and strength and finally Reaction time. Improving motor fitness involves a training regimen in all six.

SPEED

Speed is the rate of motion, or equivalently the rate of change in position, often expressed as distance travelled per unit of time

POWER

Power refers to the athlete's ability to contract his or her muscles forcefully in an explosive movement. Most people have an intuitive sense of what power is, and why it is important for sports.

AGILITY

Agility refers to the body's ability to perform quick movements in different directions. It is sometimes described as how fast an athlete is able to change direction while competing on the field or on the court.

II-REVIEW OF LITERATURE

One of the very important early steps in a research project is performing the review of literature. This is also one of the most humbling experiences we are likely to have. It is because we are most likely to find out that any important idea we have, has been thought of before, at least to some extent. A literature review is always performed to identify related studies, to set the current project within the conceptual and theoretical context. When looked at that way, almost no topic is so new or unique that you can't locate relevant and informative related studies.

In the literature review we can find the following things**:**

First, the researcher can find a study that is quite similar to the one we are thinking of doing. Since all authentic and credible research studies have to review the literature themselves, we can verify their literature review to get started on our own study.

Second, prior research will help ensure that we include all of the important relevant constructs in our study. We may find that other similar studies routinely look at an outcome that we might not have included. Our study would not be judged properly if it ignored a major construct.

Third, the literature review will help us to find and select appropriate measurement instruments/tools. We will readily see what measurement instruments/tools those researchers used themselves in contexts similar to ours.

Finally, the literature review will help us to anticipate common problems in our study context. We can use the prior experiences of others to avoid common traps and pitfalls.

SECTIONS

- **SECTION A : Studies on influence of core strengthening exercise in atheletics.**
- **SECTION B : Studies about core weakness in athletics**
- **SECTION C : Studies on reliability and validity of test for motor fitness**

- **STUDIES ON INFLUENCE OF CORE STRENGTHENING EXERCISE IN ATHELETICS.**

- **Sato and Mokha**.states that Core strength training may be an effective training method for improving performance in runners. (J Strength Cond Res. 2009 Jan;23(1):133-40)
- **Sharma and Geovinson** states that Nine-week strategic core strengthening exercise program increases trunk stability and in turn improves block difference (vertical jump parameter). (J Sports Med Phys Fitness. 2012 Dec;52(6):606-15.)
- **Kibler, and Aaron** states that proximal stability for distal mobility, a proximal to distal patterning of generation of force, and the creation of interactive moments that move and protect distal joints.
- **John D. Willson**, etallstates that Core stability may provide several benefits to the musculoskeletal system, from maintaining low back health to preventing knee ligament injury.
- **STUDIES ABOUT CORE WEAKNES IN ATHLETICS**
- **Sharrock, Cropper** et all states that There appears to be a link between a core stability test and athletic performance tests; however, more research is needed to provide a definitive answer on the nature of this relationship. (Int J Sports PhysTher. 2011 June; 6(2): 63–74.)

- **STUDIES ON RELIABILITY AND VALIDITY OF TEST FOR MOTOR FITNESS POWER**

  - **Tyler Hamilton** etall states that Triple-hop distance is a useful clinical test to predict an athlete's lower extremity strength and power (J Athl Train.2008 Mar-Apr; 43(2): 144151.)

  - **Matthew Buckthorpe** etallststes that Vertical jump height is thought to provide a valuable index of muscular power, which is an important factor in sports performance and for assessing the mobility and functional capacity of injured or aged individuals. In conclusion, the portable force plate and belt mat devices provided valid measures of vertical jump height, whereas the Vertex and not. Contact mat devices did. (Journal of Sports Sciences Volume 30, Issue 1, 2012)

  - **D. J. Glencross**[a] states that The jump-reach test and standing broad jump were investigated as tests of muscle power. The criterion used was the power lever. An analysis of the variance components of the two jump tests revealed that each test involved a large proportion of specific variance. Of the common factor variance muscle power appeared to be only one component. A multi-dimensional factor, jumping ability, was important to both the jump-reach test and standing broad jump. These tests appeared to have limited application as measures of muscle power.(Research Quarterly. American Association for Health, Physical Education and RecreationVolume 37, Issue 3, 1966)

AGILITY

- **. Sheppard[a*] & Young** states that Agility testing is generally confined to tests of physical components such as change of direction speed, or cognitive components such as anticipation and pattern recognition. New tests of agility that combine physical and cognitive measures are encouraged. (Journal of Sports SciencesVolume 24, Issue 9, 2006)
- **Vescovi[a*]** states that Relationships between sprinting, agility, and jump ability in female athletes. (Volume 26, Issue 1, 2008)
- **Matthew** etall, ststes that Vertical jump height is thought to provide a valuable index of muscular power, which is an important factor in sports perfomance and for assessing the mobility and functional capacity of injured or aged individuals.In conclusion, the portable force plate and belt mat devices provided valid measures of vertical jump height, whereas the Vertec and not.contact mat devices did. (Journal of Sports Sciences Volume 30, Issue 1, 2012)

SPEED :

- **Baker and Newton** conducted this study on elite first-division national rugby league (NRL) players and second-division league (SRL) to evaluate the power ,acceleration ,maximal speed,agility,lower body strength and sprint momentum(2008).
- **Tim et al** Carried out a study on junior rugby league players contending at elite and sub-elite level with the reason to examine their physical characteristics,and find out whether preseason fitness level were fundamentally diverse for the players elected in first season than non-elected.(2008)

III. METHDOLOGY.

3.1 STUDY DESIGN.

Pre-test Post-test Experimental Design,

3.2 STUDY SETTING

This study was conducted in Cherraan's college athletics.

3.3 SELECTION OF SUBJECTS.

15 subjects aged between 13 and 22 years who fulfilled inclusion and exclusion criteria were selected by purposive sampling method and randomely assigned.

3.4 STUDY DURATION

The studies duration is 6 months.

3.5 CRITERIA FOR SELECTION OF SUBJECTS

Inclusion criteria.

- Both sex were include for the study.
- The subject belong the age group between 13 and 22

Exclusion criteria

- Recent injured athletics.
- Neurological disorder athletics.
- Limb length difference subjects.
- Recent surgery in lower limb.
- Low back pain subjects.

3.6 VARIABLES OF THE STUDY

Dependent variables.

Speed, agility, power,

Independent variable

Core strengthening exercises

3.7 MEASUREMENT TOOLS

1. To check lumbo-pelvic stability

Double Straight Leg Lowering Test

2.To check speed.

30 yard dash

4. To check power.

Sergeant jump test.

5. To check agility.

Illinois agility test

3.8 PROCEDURE

- **MEASUREMENT PROCEDURE**
  - **To check lumbo-pelvic stability**

Double Straight Leg Lowering Test

This is an abdominal eccentric test that can place a great deal of stress on the spine so the examiner must ensure the patient is able to hold a neutral pelvis before doing the exercise. It also causes greater abdominal activation than curl-ups. The patient lies supine and flexes the hip to 90* and then straightens the knees. The patient then positions the pelvis in neutral by doing a posterior pelvic tilt and holding the spinous process tightly against the examining table. The straight legs are eccentrically lowered. As soon as the ASIS start to rotate forward, the test is stopped, the angle measured and the knees bent. The test must be done slowly, and the patient must not hold his or her breath. The grading of the test is as follows;

Normal (5); arms crossed over chest, until scapula or able to reach 0* to 15 * from table before pelvis tilts

Good (4); Able to reach 16* to 45* from table before pelvis tilts.

Fair (3); Able to reach 46* to 75* from table before pelvis tilts

Poor (2); Able to reach75* to 90* from table before pelvis tilts

Trace (1); Unable to hold pelvis in neutral at all.

- **TO CHECK SPEED**

1.**30 yard dash**

The test involves running a single maximum sprint over 30 meters, with the time recorded. Start from a stationary position, with one foot in front of the other. The front foot must be on or behind the starting line. This starting position should be held for 2 seconds prior to starting, and no rocking movements are allowed. The tester should provide hints for maximizing speed (such as keeping low, driving hard with the arms and legs) and encouraged to continue running hard through the finish line.

- **TO CHECK POWER**

1.**Sergeant jump test.**

Chalks the end of the athlete fingertip. Stands side on the to the wall, keeping both leg reaming on the ground, reaches up a high as possible with one hand and marks the wall with the tip of fingers (M1) from a static position jumps as high as possible and marks the wall with the chalk on the fingertip (M2), then measure the distance from M1 to M2.

2.**Standing broad jump**

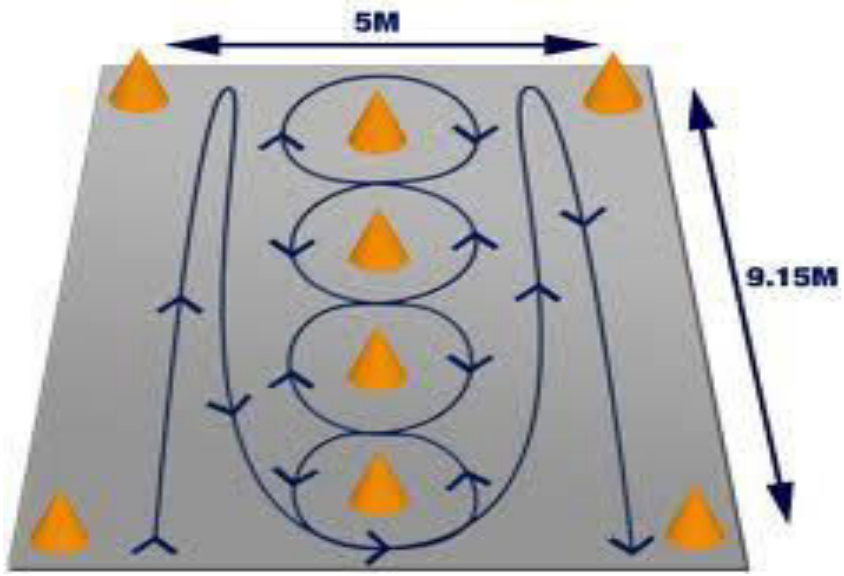
Athletes stands behind a line marked on the ground with the feet slightly apart. A two foot take-off and landing is used with swing of the arms and bending of the knees to provide forward drive. The subject attempts to jump as far as possible, landing on both feet without failing backwards. Three attempts are allowed.

Scoring; the measurement is taken from take-off line to the nearest point of the landing.

TO CHECK AGILITY

1.**Illinois agility test**

The length of the course is 10meters and the width is 5meters. Four cones are used to mark the start, finish and the two turning points, another 4 cones are placed down the center an equal distance apart. Each cones in the center is spaced 3.3meters apart. Subject should lie on their front and hands by their shoulders, on the "GO" command the stopwatch is started and the athlete gets up as quick as possible and runs around the course in the direction indicated, without knocking the cones cover to the finish line, at which the timing is stopped (excellent score <15.2sec in males <17 for females)



1. Fig 8: Illinois agility test

- **TREATMENT PROCEDURE.**

Abdominal Draw In with Knee to Chest Lie on your back on table or mat, draw one knee to the chest while maintaining the abdominal draw in; do not grab the knee with your hand. Repeat 10-20 times each leg

Crunches exercise

Fig 9;

a) Lie on your back with your knees bent and your feet flat on the floor. b) "Crunch" or curl your stomache to lift your shoulders just off the floor.

Try not to use your hip flexor muscles to carry out this movement, or use your arms to pull up your head

Aim to complete 3 x 30 crunches, with 30 seconds of recovery between sets.

Oblique Crunches

Fig 10; oblique crunches

a) Lie on your back. Raise your legs and bend them so that you form a right angle at your hips and your knees. Place your hands gently on the side of your head. b) Lift your shoulders off the floor and twist, reaching your right elbow towards your left leg. c) Return to the floor then repeat, twisting in the opposite direction.Take care not to rock. Your hips and legs should stay as still as possible, allowing your trunk to do all of the work.

The Plank exercise

Fig 11; plank exercise.

a) Assume a front-support position resting on your fore-arms with your shoulders directly over your elbows. b) Straighten your legs out behind you and lift up your hips to form a dead-straight line from your shoulders to your ankles. You should be balanced on your fore-arms and toes, with your lower abdomen and back working to keep your body straight. Hold for 1 minute.

Aim to complete 3 x 30 crunches, with 30 seconds of recovery between sets.

Aim to complete 3 x 30 crunches (15 on each side per set) with 30 seconds of recovery between sets.

Oblique Plank exercise

fig 12

a) On your side, balance on your right fore-arm with your shoulder above your elbow. b) With your legs out straight to the left, lift your pelvis so that you are balanced on your fore-arm and feet. Your body should form a straight line and you should feel the oblique muscles down the side of your trunk working to maintain the position. c) Hold for 1 minute then repeat on other side.

Static Leg and Back Exercise

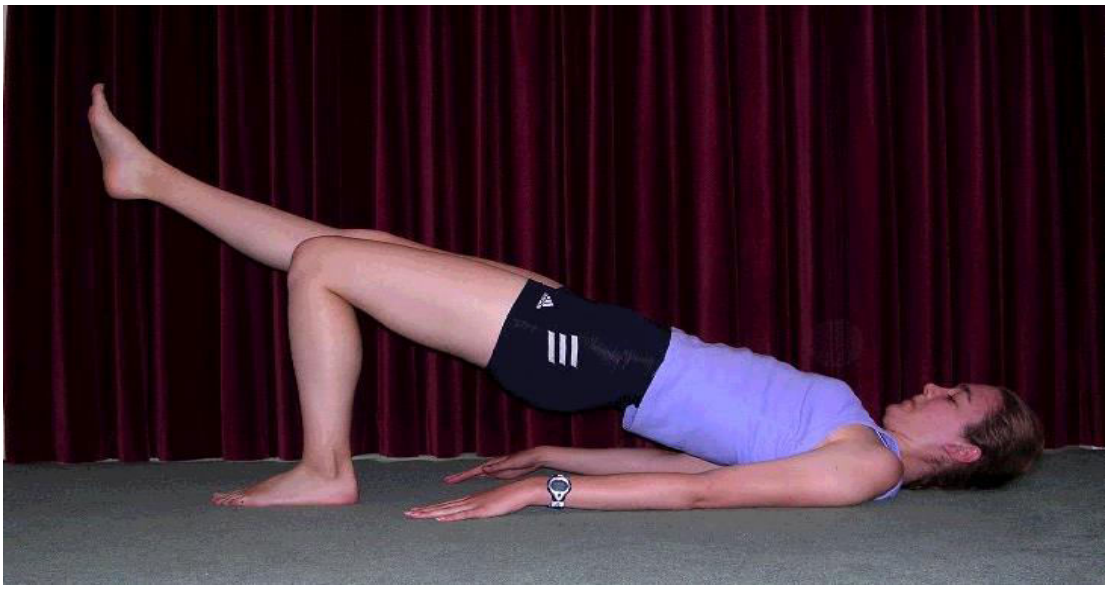


fig 13

a) Lie on your back with your knees bent and your feet flat on the floor. **b)** Lift your pelvis so that you form a bridge position with a straight line running from your shoulders to your knees. **c)** Lift your right leg off the floor and extend it so that it continues the straight line. You should be able to feel your left buttock, your back, and lower abdomen working to keep the position. **d)** Hold for 30 seconds then repeat on the other leg.

Dynamic Leg and Back Exercise

fig 14

a) Assume the same position as for the "Static leg and back". **b)** Lower your pelvis but do not allow it to tilt or touch the floor. This should be a slow, controlled movement. **c)** Return to the original position, restoring the straight line from shoulders to toe.You may find it easier to balance if you hold your free arm out. This will also make the exercise a bit easier by altering the distribution of your weight.Make sure that your pelvis does NOT tilt at all while your leg is raised. Your hips should be level at all times. Aim to complete 10 on each leg. Stop if you feel your hamstring tighten.

Hamstring Raises Exercise

fig 15

a) Balance on the floor on your hands and knees. Your back should be flat and your hips parallel to the floor. **b)** Raise one leg behind you until you cannot lift it any higher without rotating your hips or arching your back. The movement should be slow and controlled. **c)** Return the leg to the floor and repeat.

“Superman” Exercise

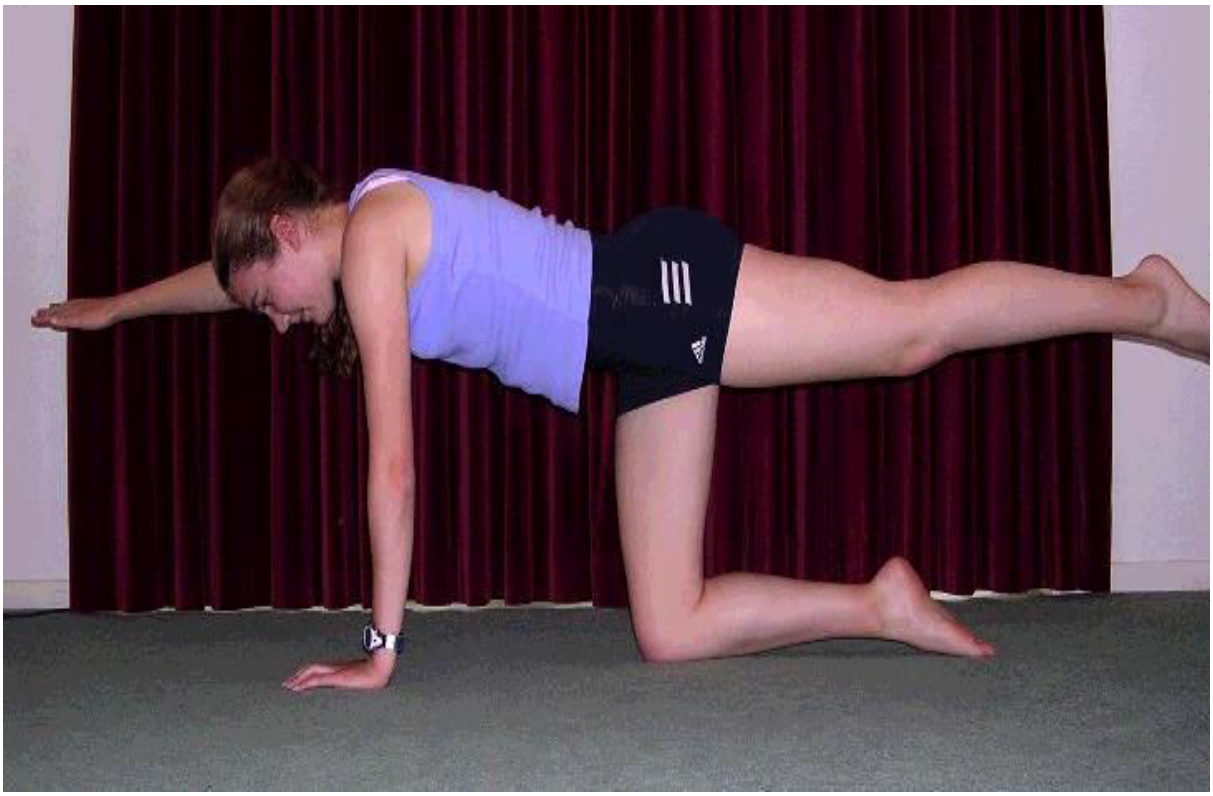


fig 16

a) Balance on the floor on your hands and knees. Your back should be flat and hips parallel to the floor. **b)** Raise your right arm out in front of you and raise your left leg out behind you, keeping it straight. **c)** Hold for 30 seconds and then repeat on the other side.

Static Straight Legs

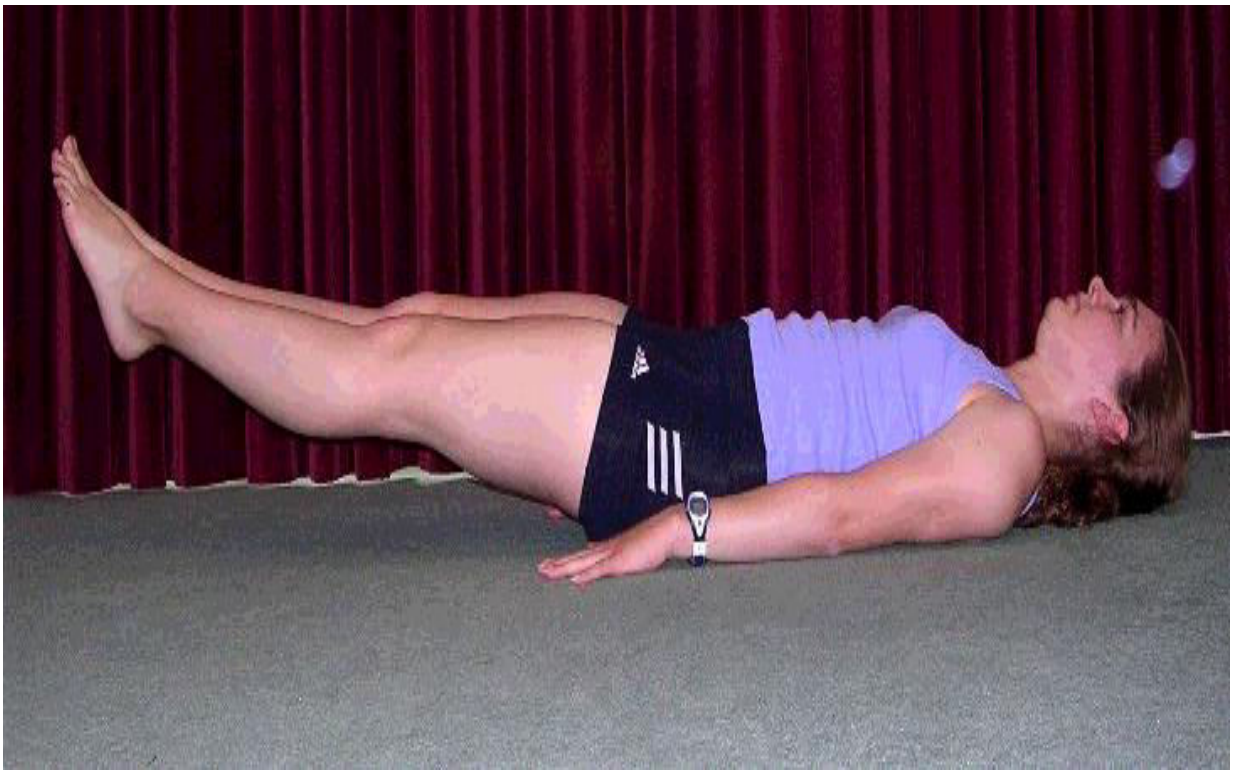


Fig 17;

a) Lie on your back with your legs together and your arms by your sides. b) Keeping your legs straight, lift your heels approximately 4 inches off the floor. c) Hold for 1 minute

Lowering and Raising Legs

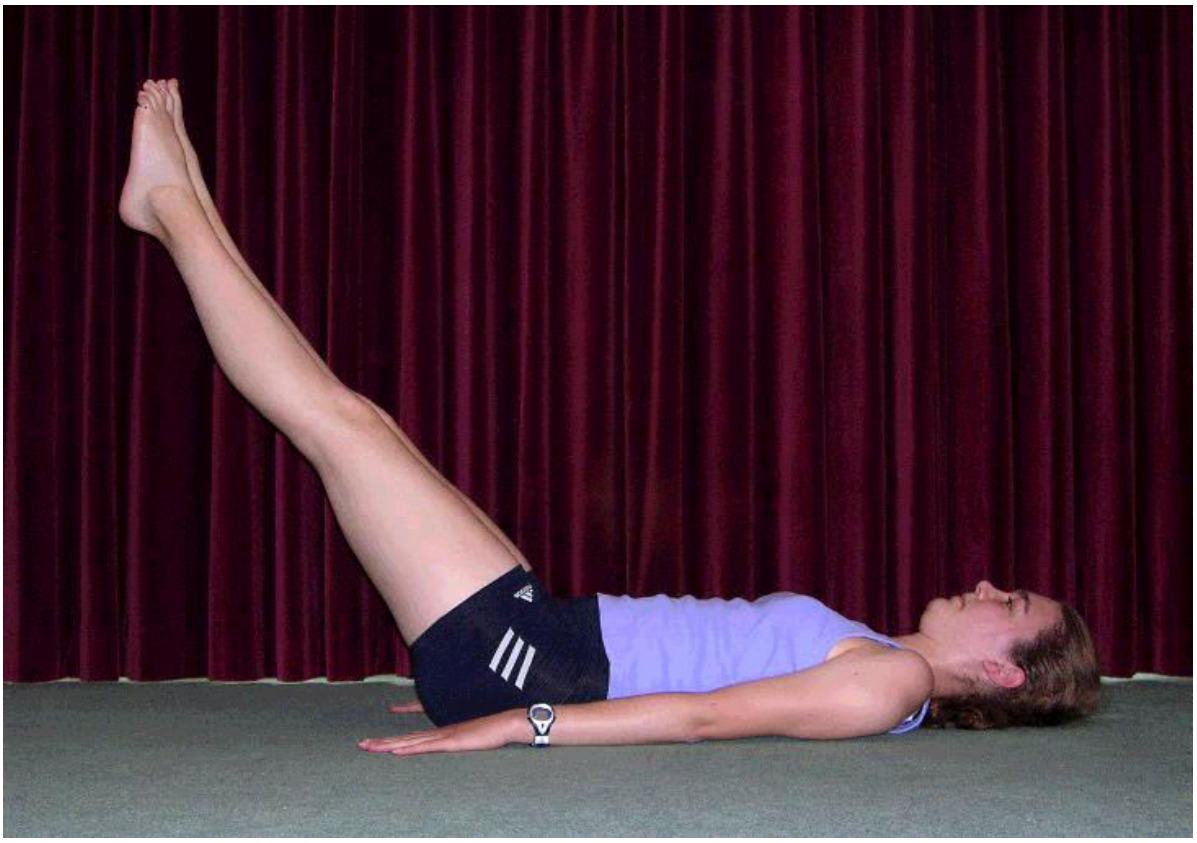


fig 18

a) Lie with your back flat on the floor and your legs raised above your hips.

b) Lower your legs for 30 seconds until the heels are about 4 inches from the floor. Without allowing your heels to touch down, raise them for another 30 seconds.

Complete 15 repetitions one one leg, and the repeat on the other leg.

Concentrate on keeping completely still with your hips square and your back flat. (superman) Do not allow your back to arch. The small of your back should be flat on the floor. Keep your legs straight and do not allow your back to arch. Try not to move too quickly.

Hundreds

fig 19

a) Lie on your back with your arms by your sides. Raise your legs and bend them so that you form a right angle at your hips and knees. b) Keeping your arms straight and lifting your hands no more than a few inches, gently tap the floor 100 times.

Leg Extensions

Fig 20 **:**

a) Lie on your back. Raise your legs and bend them so that you form a right angle at your hips and knees.b) Keeping your hips completely still, lower and straighten out one leg so that your heel is about 4 inches from the floor. The movement should be slow and controlled. c) Return to the original position and repeat on the other leg.

IV DATA ANALYSIS AND RESULTS

4.1DataAnalysis and Interpretation

The data collected from 15 subjects were evaluated statistically. The experimental study was done by using Paired‘t’ test.

a)Paired‘t’ test $\bar{d} = \frac{\sum d}{n}$

$$s = \frac{\sqrt{\sum d^2 - \frac{\sum (d)^2}{n}}}{n - 1}$$

$t = \frac{\bar{d}\sqrt{n}}{s}$

Where,

d – Difference between pre-test and post-test values

$\bar{d} = \frac{\sum d}{n}$ – Mean of difference between pre test and post test values

n – Total number of subjects

s – Standard deviation

Table 3: Shows Mean value, Mean Difference, Standard Deviation and Paired 't' value between pre and post test scores of Power among triple jumpers

Measurement	Mean	Mean Difference	Standard Deviation	Paired 't' value
Pre-test	38.3	12.3	0.2846	23.9
Post-test	26			

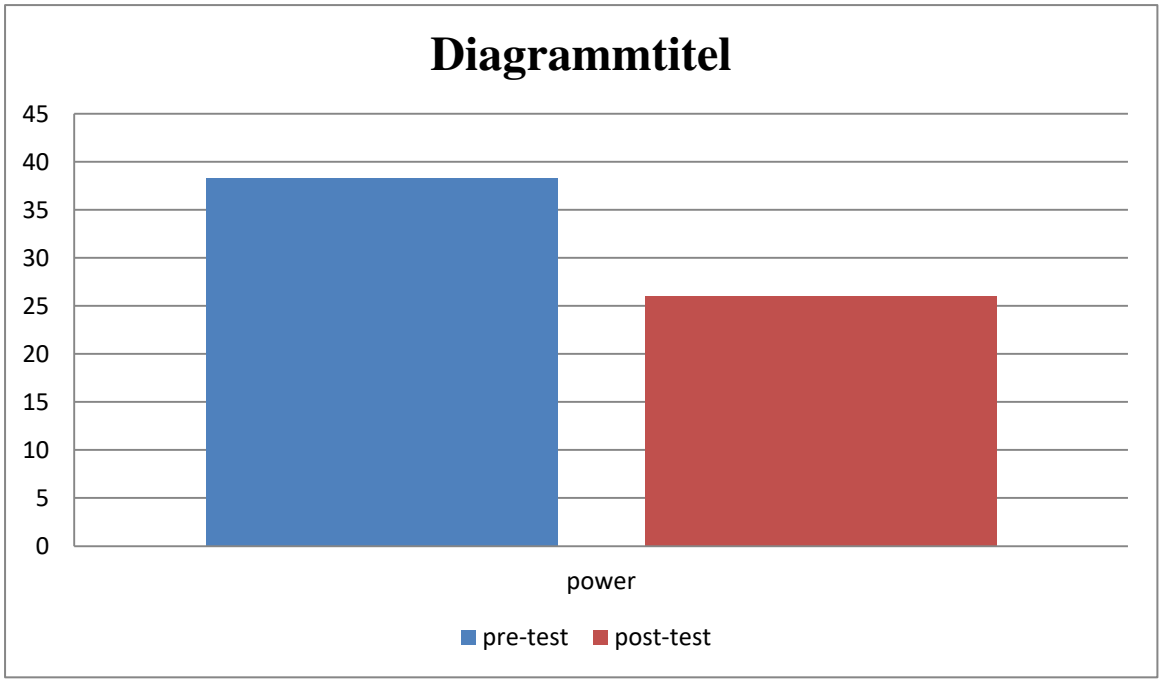


Figure 21; Bar diagram showing pre and post test mean values of power of triple jumpers.

Table 4: Show Mean value, Mean Difference, Standard Deviation and Paired‘t’ value between pre and post test scores of speed among triple jumpers.

Measurement	Mean	Mean Difference	Standard Deviation	Paired ‘t’ value
Pre test	121.6	62.6	0.46	32.17
post test	59			

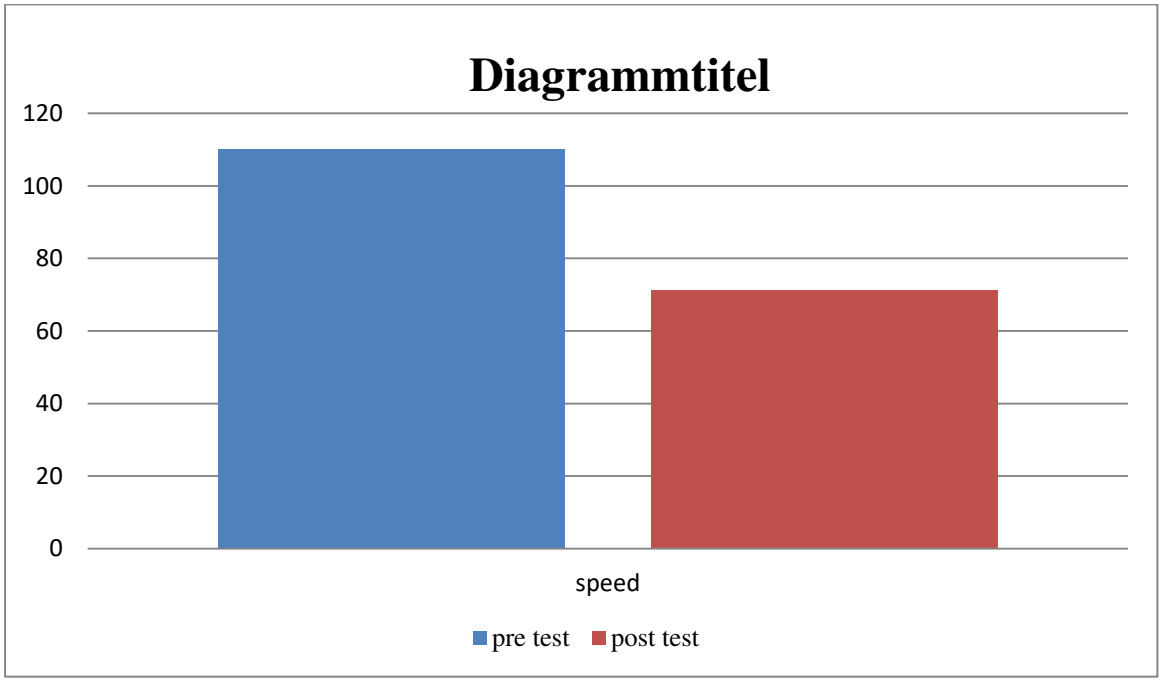


Figure 22; Bar diagram showing pre and post-test mean values of speed of triple jumpers.

Table 5: Show Mean value, Mean Difference, Standard Deviation and Paired‘t’ value between pre and post test scores of agility among triple jumpers.

Measurement	Mean	Mean Difference	Standard Deviation	Paired ‘t’ value
Pre test	195.59	35.32	0.2062	44.08
post test	160.27			

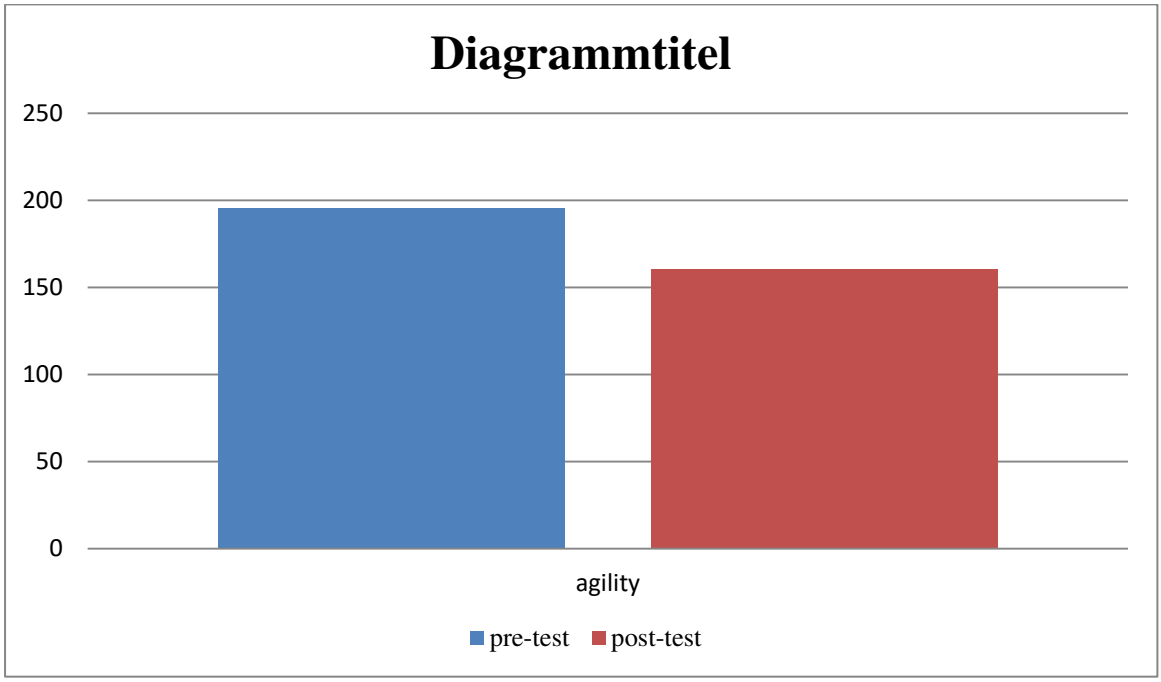


Figure 23; Bar diagram showing pre and post test mean values of agility of triple jumpers.

4.2 RESULT AND DISCUSSION

In the experimental study the subject was treated with core strengthening exercises.

- **Analysis of Dependent Variable power of triple jumpers:** The Calculated Paired‘t’ value is 23.9 the Table ‘t’ value is 2.97 at 0.005 level of significance. Hence, the calculated‘t’ value is greater than the Table‘t’ value there is significant difference in power following the core strengthening exercises in triple jumpers. Since we accept alternative hypothesis and reject null hypothesis.
- **Analysis of Dependent Variable speed of triple jumpers:** The Calculated Paired‘t’ value is 32.17 theTable‘t’ value is 2.97 at 0.005 level of significance. Hence, the calculated‘t’ value is greater than the Table‘t’ value there is significant difference in speed following the core strengthening exercises in triple jumpers.Since we accept alternative hypothesis and reject null hypothesis.
- **Analysis of Dependent Variable agility of triple jumpers:** The Calculated Paired‘t’ value is 44.08 the Table‘t’ value is 2.97 at 0.005 level of significance. Hence, the calculated‘t’ value is greater than the Table‘t’ value there is significant difference in agility following the core strengthening exercises in triple jumpers. Since we accept alternative hypothesis and reject null hypothesis.

V. DISCUSSION

The purpose of this study is to evaluate the effects of core strengthening exercises and to find the improvement of motor fitness variablesin triple jumpers.

The results of the present study indicate that the improvement of the core muscle strength also can improve the motor fitness like power, agility and speed.

5.1 Discussion on Hypotheses

In Hypothesis the researcher stated that **t**here is significant difference in the speed, agility and power in athletics by improving their core muscle strength. The result shows that there is significant difference in motor variables while improving the lumbo pelvic muscle strength.. Therefore the Hypothesis was accepted.

VI. SUMMARY AND CONCLUSION

6.1 Summary

A Pre-test Post-test Experimental study was conducted to find the effectiveness of core muscle strength and there by improving the motor fitness variables in the triple jumpers.

15 subjects were selected included in this study by purposive sampling.

Subjects were treated with core muscle strengthening exercises. Power, speed and agility were assessed before and after the intervention by Double Straight Leg Lowering Test, 30 yard dash test, Standing broad jump, Illinois agility test

6.2 Conclusion

- It is concluded that there is improvement of core muscle strength in the atheletics.
- It is concluded that there is improvement in speed, agility and power treated with core muscle strength.

6.3 Limitations

The study was conducted with a sample size of 15, the age group of the sample being 13 to 22 years with treatment duration of 6 months.

6.4 Recommendation

Future research can be conducted with a larger sample size, wider age group, different variables, more consistent outcome measures and different treatment durations.

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Table: 13 Pre and post-test of power among athletics

Sl no	Pre-test	Post-test	Difference(d)	Difference squared(d2)
1	2.3	3.6	1.3	1.69
2	2.5	3.6	1.1	1.21
3	2.5	3.8	1.3	1.69
4	2.6	4	1.4	1.96
5	2.1	4	1.9	3.61
6	2.2	3.7	1.5	2.25
7	2.5	4.4	1.9	3.61
8	2.3	3.8	1.5	2.25
9	2.6	4	1.4	1.96
10	2.1	4	1.9	3.61
11	2.5	4.2	1.7	2.89
12	2.7	4.5	1.8	3.24
13	2.2	4.7	2.5	6.25
14	2.3	3.9	1.6	2.56
15	2.4	4.1	1.7	2.89

ANNEXURE-1

Table: 13 Pre and post-test values of speed among athletics

Sl no	Pre-test	Post-test	Difference(d)	Difference squared(d2)
1	7	5.1	1.9	3.61
2	7.3	5	2.3	5.29
3	8	5.2	2.8	7.84
4	7.2	5	2.2	4.84
5	8.9	5.3	3.6	12.96
6	7.5	5.2	2.3	5.29
7	7	5	2	4
8	6.9	4.2	2.7	7.29
9	8.2	5.1	3.1	9.61
10	7.2	4.6	2.6	6.76
11	7	4.3	2.7	7.29
12	8.1	4.7	3.4	11.56
13	6.6	4	2.6	6.76
14	7	4.2	2.8	7.84
15	6.9	4.3	2.6	6.76

Table: 13 Pre and post-test values of agility among atheletics

Sl no	Pre-test	Post-test	Difference(d)	Difference squared(d2)
1	11.94	10	1.94	3.76
2	11.36	9.56	1.8	3.24
3	12.10	10.30	1.8	3.24
4	13.54	11.12	2.42	5.85
5	13.44	10	3.44	11.83
6	12.58	10.08	2.5	6.25
7	13.43	10.12	3.31	10.95
8	12.68	9	3.68	13.54
9	14	11.23	2.77	7.67
10	14	12.14	1.86	3.45
11	13.44	10.84	2.6	6.7
12	14	12.87	1.13	1.28
13	13.50	12.01	1.49	2.22
14	12.58	11	1.58	2.49
15	13	10	3	9

ANNEXURE-2

PATIENT CONSENT FORM

I……Voluntarily consent to participate in the research named on **"A STUDY ON EFFECT OF LUMBO-PELVIC STABILITY EXERCISES ON MOTOR FITNESS VARIABLES AMONG TRIPLE JUMPERS".** The researcher has explained me the treatment approach in brief, risk of participation and has answered the questions related to the study to my satisfaction.

Signature of patient **Signature of researcher**

Signature of witness

Place:

Date: